

CLAIMS

What is claimed is:

1. A data output circuit comprising:

5 a first inversion unit receiving a first data signal of an operating voltage level and inverting the received first data signal to obtain a first inverted data signal;

a first voltage compensation unit compensating for the voltage level of the first inverted data signal to obtain a first driving signal, if a first power supply voltage of an output voltage level is different from a second power supply voltage of the operating
10 voltage level by at least a predetermined voltage level;

a second inversion unit receiving a second data signal with the operating voltage level and inverting the received second data signal to obtain a second inverted data signal;

15 a second voltage compensation unit compensating for the voltage level of the second inverted data signal to obtain a second driving signal, if the levels of the first and second power supply voltages are different by at least a predetermined voltage level; and

20 a driver unit receiving the first and second driving signals and outputting an output data signal of a logic level that is opposite the logic levels of the first and second driving signals.

2. The data output circuit of claim 1, wherein the first inversion unit forms an inverter comprising a first PMOS transistor and a first NMOS transistor serially connected between the first power supply voltage and a first ground voltage of the
25 output voltage level, and wherein the first data signal is applied to a gate of the first PMOS transistor and a gate of the first NMOS transistor.

3. The data output circuit of claim 1, wherein the second inversion unit forms an inverter comprising a second PMOS transistor and a second NMOS transistor
30 serially connected between the first power supply voltage and a first ground voltage of

the output voltage level, and wherein the second data signal is applied to a gate of the second PMOS transistor and a gate of the second NMOS transistor.

4. The data output circuit of claim 1, wherein the first voltage compensation unit comprises:

a first compensation PMOS transistor a source of which is connected to the second power supply voltage and a gate of which is subjected to the first power supply voltage; and

a second compensation PMOS transistor a source of which is connected to the drain of the first compensation PMOS transistor, a gate of which is subjected to the first data signal, and a drain of which is connected to a connection node between the first PMOS transistor and the first NMOS transistor.

5. The data output circuit of claim 4, wherein the first voltage compensation unit compensates for the voltage level of the first inverted data signal if the first and second power supply voltages are different by at least a threshold voltage level of the first compensation PMOS transistor.

6. The data output circuit of claim 1, wherein the second voltage compensation unit comprises:

a third compensation PMOS transistor a source of which is connected to the second power supply voltage and a gate of which is subjected to the first power supply voltage; and

a fourth compensation PMOS transistor a source of which is connected to the drain of the third compensation PMOS transistor, a gate of which is subjected to the second data signal, and a drain of which is connected to a connection node between the second PMOS transistor and the second NMOS transistor.

7. The data output circuit of claim 6, wherein the second voltage compensation unit compensates for the voltage level of the second inverted data signal

if the first and second power supply voltages are different by at least a threshold voltage level of the third compensation PMOS transistor.

5 8. The data output circuit of claim 1, wherein the first and second data signals have the same level.

9. The data output circuit of claim 1, wherein the first voltage compensation unit comprises:

10 a first compensation PMOS transistor a source of which is connected to the second power supply voltage and a gate of which is subjected to a first drop voltage;

 a second compensation PMOS transistor a source of which is connected to the drain of the first compensation PMOS transistor, a gate of which is subjected to the first data signal, and a drain of which is connected to a connection node between the first PMOS transistor and the first NMOS transistor;

15 first through N-th load PMOS transistors serially connected to the first power supply voltage; and

 a first load NMOS transistor connected between the N-th load PMOS transistor and a second ground voltage, a drain of which generates the first drop voltage and a gate and a source of which are connected to each other.

20 10. The data output circuit of claim 9, wherein the first voltage compensation unit compensates for the voltage level of the first inverted data signal if the second power supply voltage and the first drop voltage are different by at least the threshold voltage level of the first compensation PMOS transistor, and the level of the first drop
25 voltage is determined according to the number of first through N-th load PMOS transistors.

11. The data output circuit of claim 1, wherein the second voltage compensation unit comprises:

30 a third compensation PMOS transistor a source of which is connected to the second power supply voltage and a gate of which is subjected to a second drop voltage;

a fourth compensation PMOS transistor a source of which is connected to the drain of the third compensation PMOS transistor, a gate of which is subjected to the second data signal, and a drain of which is connected to a connection node between the second PMOS transistor and the second NMOS transistor;

(N+1)th through M-th load PMOS transistors serially connected to the first power supply voltage; and

a second load NMOS transistor connected between the M-th load PMOS transistor and a second ground voltage, a drain of which generates the second drop voltage and a gate and a source of which are connected to each other.

12. The data output circuit of claim 11, wherein the second voltage compensation unit compensates for the voltage level of the second inverted data signal if the second power supply voltage and the second drop voltage are different by at least the threshold voltage level of the third compensation PMOS transistor, and the level of the second drop voltage is determined according to the number of (N+1)th through M-th load PMOS transistors.

13. A data output circuit comprising:

a first inversion unit receiving a first data signal of an operating voltage level and inverting the received first data signal to obtain a first inverted data signal, if an output voltage level of a first power supply voltage is equal to an operating voltage level of a second power supply voltage;

a first voltage compensation unit compensating for the voltage level of the first inverted data signal to obtain a first driving signal, if the levels of the first and second power supply voltages are different by at least a predetermined voltage level;

a second inversion unit receiving a second data signal of the operating voltage level and inverting the received second data signal to obtain a second inverted data signal, if the levels of the first and second power supply voltages are the same;

a second voltage compensation unit compensating for the voltage level of the second inverted data signal to obtain a second driving signal, if the levels of the first and

second power supply voltages are different by at least a predetermined voltage level;
and

a driver unit receiving the first and second driving signals and outputting an
output data signal of a logic level that is opposite the logic levels of the first and second
driving signals.

14. The data output circuit of claim 13, wherein the first inversion unit
comprises:

a first inversion PMOS transistor a source of which is connected to the first power
supply voltage and a gate of which is subjected to a first control voltage;

a second inversion PMOS transistor a source of which is connected to the drain
of the first inversion PMOS transistor, a gate of which is subjected to the first data signal,
and a drain of which generates the first inverted data signal;

a first inversion NMOS transistor a drain of which is connected to the drain of the
second inversion PMOS transistor, a gate of which is subjected to the first data signal,
and a source of which is connected to a first ground voltage; and

a first control voltage generation unit generating the first control voltage to have a
first logic level, if the levels of the first and second power supply voltages are the same,
and generating the first control voltage to have a second logic level, if the level of the
first power supply voltage is less than that of the second power supply voltage by a
predetermined voltage level.

15. The data output circuit of claim 14, wherein the first control voltage
generation unit comprises:

a first control PMOS transistor a source of which is connected to the second
power supply voltage and a gate of which is subjected to the first power supply voltage;

first through N-th load PMOS transistors serially connected to the first control
PMOS transistor; and

a first control NMOS transistor connected between the N-th load PMOS transistor
and a second ground voltage, a drain of which generates the first control voltage and a
gate and a source of which are connected to each other.

16. The data output circuit of claim 13, wherein the first voltage compensation unit comprises:

a first compensation PMOS transistor a source of which is connected to the second power supply voltage and a gate of which is subjected to the first power supply voltage; and

a second compensation PMOS transistor a source of which is connected to the drain of the first compensation PMOS transistor, a gate of which is subjected to the first data signal, and a drain of which is connected to a connection node between the second inversion PMOS transistor and the first inversion NMOS transistor.

17. The data output circuit of claim 16, wherein the first voltage compensation unit compensates for the voltage level of the first inverted data signal if the first and second power supply voltages are different by at least a threshold voltage level of the first compensation PMOS transistor.

18. The data output circuit of claim 13, wherein the second inversion unit comprises:

a third inversion PMOS transistor a source of which is connected to the first power supply voltage and a gate of which is subjected to a second control voltage;

a fourth inversion PMOS transistor a source of which is connected to the drain of the third inversion PMOS transistor, a gate of which is subjected to the second data signal, and a drain of which generates the second inverted data signal;

a second inversion NMOS transistor a drain of which is connected to the drain of the fourth inversion PMOS transistor, a gate of which is subjected to the second data signal, and a source of which is connected to a first ground voltage; and

a second control voltage generation unit generating the second control voltage to have a first logic level, if the levels of the first and second power supply voltages are the same, and generating the second control voltage to have a second logic level, if the level of the first power supply voltage is less than that of the second power supply voltage by a predetermined voltage level.

19. The data output circuit of claim 18, wherein the second control voltage generation unit comprises:

5 a second control PMOS transistor a source of which is connected to the second power supply voltage and a gate of which is subjected to the first power supply voltage; (N+1)th through M load PMOS transistors serially connected to the second control PMOS transistor; and

10 a second control NMOS transistor connected between the M-th load PMOS transistor and a second ground voltage, a drain of which generates the second control voltage and a gate and source of which are connected to each other.

20. The data output circuit of claim 13, wherein the second voltage compensation unit comprises:

15 a third compensation PMOS transistor a source of which is connected to the second power supply voltage and a gate of which is subjected to the first power supply voltage; and

20 a fourth compensation PMOS transistor a source of which is connected to the drain of the third compensation PMOS transistor, a gate of which is subjected to the second data signal, and a drain of which is connected to a connection node between the fourth inversion PMOS transistor and the second inversion NMOS transistor.

21. The data output circuit of claim 20, wherein the second voltage compensation unit compensates for the voltage level of the second inverted data signal if the first and second power supply voltages are different by at least a threshold voltage level of the third compensation PMOS transistor.

22. The data output circuit of claim 13, wherein the first and second data signals have the same level.

23. A data output circuit comprising:

a first inversion unit receiving a first data signal of an operating voltage level and inverting the received first data signal to obtain a first inverted data signal, if an output voltage level of a first power supply voltage is equal to an operating voltage level of a second power supply voltage;

a first voltage compensation unit compensating for the voltage level of the first inverted data signal to obtain a first driving signal, if the levels of the first and second power supply voltages are different by at least a predetermined voltage level;

a first control unit generating a first control signal for controlling the operation of the first voltage compensation unit if the levels of the first and second power supply voltages are the same and generating a second control signal for controlling the operation of the first inversion unit if the levels of the first and second power supply voltages are different by at least a predetermined voltage level;

a second inversion unit receiving a second data signal of an operating voltage level and inverting the received second data signal to obtain a second inverted data signal, if the levels of the first and second power supply voltages are the same;

a second voltage compensation unit compensating for the voltage level of the second inverted data signal to obtain a second driving signal, if the levels of the first and second power supply voltages are different by at least a predetermined voltage level;

a second control unit generating a third control signal for controlling the operation of the second voltage compensation unit if the levels of the first and second power supply voltages are the same and generating a fourth control signal for controlling the operation of the second inversion unit if the levels of the first and second power supply voltages are different by at least a predetermined voltage level; and

a driver unit receiving the first and second driving signals and outputting an output data signal at a logic level that is opposite to the logic levels of the first and second driving signals.

24. The data output circuit of claim 23, wherein the first inversion unit comprises:

a first inversion PMOS transistor a source of which is connected to the first power supply voltage and a gate of which is subjected to the second control signal;

a second inversion PMOS transistor a source of which is connected to the drain of the first inversion PMOS transistor, a gate of which is subjected to the first data signal, and a drain of which generates the first inverted data signal; and

a first inversion NMOS transistor a drain of which is connected to the drain of the second inversion PMOS transistor, a gate of which is subjected to the first data signal, and a source of which is connected to a first ground voltage.

25. The data output circuit of claim 14, wherein the first control unit comprises:

a first control PMOS transistor a source of which is connected to the second power supply voltage and a gate of which is subjected to the first power supply voltage;

a first control NMOS transistor a drain of which is connected to the drain of the first control PMOS transistor, and a gate and source of which are connected to a second ground voltage;

a first inverter connected to a connection node between the first control PMOS transistor and the first control NMOS transistor, generating the first control signal; and

a second inverter connected to the first inverter, generating the second control signal.

26. The data output circuit of claim 23, wherein the first voltage compensation unit comprises:

a first compensation PMOS transistor a source of which is connected to the second power supply voltage and a gate of which is subjected to the first control signal; and

a second compensation PMOS transistor a source of which is connected to the drain of the first compensation PMOS transistor, a gate of which is subjected to the first data signal, and a drain of which is connected to a connection node between the second inversion PMOS transistor and the first inversion NMOS transistor.

27. The data output circuit of claim 23, wherein the second inversion unit comprises:

a third inversion PMOS transistor a source of which is connected to the first power supply voltage and a gate of which is subjected to a fourth control signal;

5 a fourth inversion PMOS transistor a source of which is connected to the drain of the third inversion PMOS transistor, a gate of which is subjected to the second data signal, and a drain of which generates the second inverted data signal; and

10 a second inversion NMOS transistor a drain of which is connected to the drain of the fourth inversion PMOS transistor, a gate of which is subjected to the second data signal, and a source of which is connected to a first ground voltage.

28. The data output circuit of claim 23, wherein the second control unit comprises:

15 a second control PMOS transistor a source of which is connected to the second power supply voltage and a gate of which is subjected to the first power supply voltage;

a second control NMOS transistor a drain of which is connected to the drain of the second control PMOS transistor, and a gate and source of which are connected to a second ground voltage;

20 a third inverter connected to a connection node between the second control PMOS transistor and the second control NMOS transistor, generating the third control signal; and

a fourth inverter connected to the third inverter, generating the fourth control signal.

25 29. The data output circuit of claim 23, wherein the second voltage compensation unit comprises:

a third compensation PMOS transistor a source of which is connected to the second power supply voltage and a gate of which is subjected to the third control signal; and

30 a fourth compensation PMOS transistor a source of which is connected to the drain of the first compensation PMOS transistor, a gate of which is subjected to the

second data signal, and a drain of which is connected to a connection node between the fourth inversion PMOS transistor and the second inversion NMOS transistor.

30. The data output circuit of claim 23, wherein the first and second data
5 signals have the same level.